KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 132

STAT 319 Statistics for Engineers and Scientists

First Major Exam — Monday March 10, 2014

Please check/circle your instructor's name

□ Anabosi □ Jabbar □ Malik □ Al-Sabah □ Saleh

Name: ______________________ ID #: ______________ Section# ________

☺Important Note:

Show all your work including formulas, intermediate steps and final answer.

Question No	Full Marks	Marks Obtained
1	6	
2	5	
3	3	
4	4	
5	4	
6	8	
Total	30	

$$P(A\cup B)=P(A)+P(B)-P(AB).$$

$$P(A\,|\,B)=\frac{P(AB)}{P(B)},\quad P(B)\neq 0;$$

$$P\left(E_i\,|\,B\right)=\frac{P\left(B\,|\,E_i\right)P\left(E_i\right)}{P\left(B\,|\,E_1\right)P\left(E_1\right)+\cdots+P\left(B\,|\,E_k\right)P\left(E_k\right)}\quad i=1,\cdots,k$$

$$\mu\equiv E(X)=\sum_x x\,f(x).$$

$$E(X^2)=\sum x^2\,f(x),\ \ \sigma^2\equiv E(X-\mu)^2=E(X^2)-\mu^2.$$

$$f(x)=\binom{n}{x}p^x q^{n-x};\quad x=0,1,\ldots,n;\ \ 0<p<1;\ \ q=1-p;\ \mu=np,\ \sigma^2=npq.$$

$$f(x)=q^x p,\ \ x=0,1,2,\cdots;\ q=1-p;\ \ \mu=1/p,\ \sigma^2=q/p^2.$$

$$f(x)=\binom{K}{x}\binom{N-K}{n-x}\div\binom{N}{n},\quad \max\{0,n-(N-K)\}\leq y\leq\min\{n,K\};\ \mu=np,$$

$$\sigma^2=(1-c)\,npq,\ \ (N-1)\,c=n-1,\ p=(K/N),\ q=1-p.$$

$$f(x)=\frac{(\lambda t)^x}{x!}e^{-\lambda t};\ \ x=\ 0,1,\ldots;\ \mu=\lambda t,\ \sigma^2=\lambda t.$$

$P(a<X<b)=\int_a^b f(x)dx;\quad P(X\leq k)=\int_{-\infty}^k f(x)dx$ where k is a particular value of x.

$$\mu\equiv E(X)=\int_{-\infty}^{\infty}x\,f(x)dx.$$

$$E(X^2)=\int_{-\infty}^{\infty}x^2\,f(x)dx,\quad \sigma^2\equiv V(X)=E(X^2)-\mu^2.$$

$$X\sim N(\mu,\sigma^2),\ \ Z=\frac{X-\mu}{\sigma}\sim N(0,1)$$

$$f(x)=\ \lambda\,e^{-\lambda x},\ \ x\geq 0;\ \mu=\frac{1}{\lambda},\ \ \sigma^2=\frac{1}{\lambda^2}.$$

1) The following table lists the history of 940 orders for a computer product

		Extra memory	
		yes	no
Optional high-speed processor	yes	250	110
	no	60	520

a) Knowing that the order requests extra memory, what is the probability that an order requests the optional high-speed processor? *(1pt.)*

b) Let $\mathcal{A}$ be the event that an order requests the optional high speed-processor, and let $\mathcal{B}$ be the event that an order requests extra memory, Are the two events independent? Explain. *(2pts.)*

c) find the following

i. $P(\mathcal{A}' \cup \mathcal{B})$ *(2pts.)*

ii. $P(\mathcal{A}' \cap \mathcal{B}')$ *(1pts.)*

2) A lot contains 50 printed circuit cards, and 5 are selected without replacement for functional testing.
   a) If 10 cards are defective, what is the probability that at least one defective card appears in the sample? *(3pts.)*

   b) If the sampling is with replacement, what is the probability of exactly two defective cards in the sample? *(2pts.)*

3) A study of cars arriving at a parking garage at King Fahd airport shows that the average time between arrivals is 1.2 minutes and is exponentially distributed.
   a) Find the probability that more than 2 minutes will elapse between the arrivals of cars. *(2pts.)*

   b) What is the distribution of the number of cars arriving at the parking garage? *(1pt.)*

4) If Z is a standard normal distribution, find the following.
   a) $P(Z > -1.37)$ *(1pt.)*

   b) $P(2Z < 1.65)$ *(1pt.)*

   c) z such that $P(|Z| < z) = 0.85$ *(2pts.)*

5) The compressive strength of samples of cement can be modeled by a normal distribution with a mean of 6000 kilograms per square centimeter and standard deviation of 100 kilograms per square centimeter. What is the probability that a sample's strength is between 5800 and 6250 kilograms per square centimeter? *(4pts.)*

6) A screw manufacturing process produces 2% defectives. Assume the screws are independent and that a lot contains 1000 screws.

   a) Approximate the probability that fewer than 25 screws are defective. *(5pts.)*

   b) Approximate a value so that the probability that the number of defective screws exceeds this value is at most 5%. *(3pts.)*